CLAIMS

1. An optical signal to electrical signal converter comprising:

an optical waveguide for receiving and propagating a modulated optical signal; and

a pair of electrodes disposed at positions opposite to each other sandwiching the optical waveguide within a region where an electric field applies, said electric field being generated in the optical waveguide by a nonlinear optical effect when the optical signal propagates through the optical waveguide.

2. An optical signal to electrical signal converter according to claim 1, further comprising a resonator coupled to the pair of electrodes, the resonator being capable of be excited by an electrical signal induced at the pair of electrodes by the electric field.

3. An optical signal to electrical signal converter according to claim 1 or 2, wherein the optical signal comprises a side band signal corresponding to a modulation frequency f_m.

4. An optical signal to electrical signal converter according to claim 1, wherein the optical waveguide is formed on a dielectric substrate or in the dielectric substrate and wherein the electrodes are supported by the dielectric substrate.

5. An optical signal to electrical signal converter according to claim 4, wherein at least a portion of the optical waveguide and at least a portion of the dielectric substrate are formed from a nonlinear optical material, and the electric field is generated by an optical rectifying effect when the optical signal propagates through the optical waveguide.

6. An optical signal to electrical signal converter according to claim 5, further comprising an electromagnetic wave radiating device coupled to the resonator, wherein the optical signal to electrical signal converter radiates the electrical signal as a radio signal.

7. An optical signal to electrical signal converter according to claim 4, wherein the resonator and the electromagnetic radiating device are integrated with the substrate.

8. An optical signal to electrical signal converter according to claim 7, wherein the resonator and the electrodes are connected by micro strip lines formed on the dielectric substrate.

9. An optical signal to electrical signal converter according to claim 1, wherein the modulation frequency of the optical signal is 10GHz or higher.

10. An optical signal to electrical signal converter according to claim 1, further comprising a light beam input portion coupled

to the optical waveguide.

11. An optical signal to electrical signal converter according to claim 5, wherein the nonlinear optical material is a material selected from a group consisting of lithium niobate ($LiNbO_3$), lithium tantalate ($LiTaO_3$)-based material, potassium titanyl phosphate ($KTiOPO_4$)-based material, rare earth-calcium oxyborate ($RECa_4O(BO_3)_3$, RE: a Rare Earth element)-based material, DAST (4-dimethylamino-N-methyl-4-stilbazorium-toxyrate) and 3RDCVXY (dicyanovinyl termination-dimethyl substitution-diazo).

12. An optical signal to electrical signal converter according to claim 1, wherein the optical waveguide has a periodic polarization inversion structure where the polarization direction is different from the polarization direction in the other portion.

13. An optical signal to electrical signal converter according to claim 1, further comprising a resistor connecting electrically the pair of electrodes with each other.

14. An optical signal to electrical signal converter according to claim 4, further comprising a housing accommodating the dielectric substrate.